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Summary

U.S. farmers are expected to spend $42 billion on machinery and equipment, agricultural chemicals, and energy this year, up 13 percent from 1983. Expenditures for farm machinery inputs are estimated at $13.9 billion, one-third of the total, and will be about 11 percent greater than last year. Outlays for other inputs probably will increase at rates ranging from 9 percent for fuel and lubricating oil to 23 percent for seed. Contributing to this outlook are a projected $9- to $16-billion rise in net farm income and a prospective return to production of 30 to 35 million PIK-diverted acres.

Farm machinery purchases, leases, and rentals may rise 9 percent in 1984 to $8.6 billion. Repairs and operating expenditures are expected to climb 15 percent to $5.3 billion, primarily due to the anticipated gain in planted acreage. Unit sales of farm machinery are projected to rise 5 to 8 percent, although combine sales could decline by 10 to 15 percent.

Sales of tractors over 40 horsepower have fallen steadily since 1979 when 139,000 units were sold, compared with 71,000 in 1983. Sales of combines and haying equipment have followed a similar pattern. However, 1983 sales in all machinery categories remained approximately the same as in 1982, indicating the sales decline may be bottoming out. Price increases for farm machinery also appear to be moderating. The price index for tractors and combines advanced 4.7 percent from March 1983 to March 1984, compared with a 5.5-percent hike during calendar 1983, and annual increases of 10 to 12 percent in previous years. The price index for other farm machinery followed the same pattern.

The U.S. machinery trade balance shifted dramatically from a positive $278 million in 1982 to a deficit of $93 million in 1983. Sales of tractors and harvesting machinery to Canada, our most important market, totaled $409 million in 1983, versus imports of Canadian equipment valued at $149 million. Imports of $150 million from Japan and $185 million from the Federal Republic of Germany substantially contributed to the trade deficit.

Manufacturers of farm machinery have incurred substantial net operating losses in recent years because of declining sales, rising expenses, and a buildup in inventories. Declining sales and earnings also have caused some 1,200 dealerships to close since 1981. Most farm machinery firms are cutting output to control production costs, reducing inventories, or refinancing their debt to reduce operating losses.

Pesticide use will expand significantly in 1984 as U.S. field crop acreage rises. Farmers will use around 440 million pounds, active ingredient, of herbicides, 67 million pounds of insecticides, and 7 million pounds of fungicides this season. Pesticide supplies are sufficient to meet expected demand in the major crop regions, although spot shortages of some newly marketed formulations have been reported in the Corn Belt. On average, farmers will pay about 7 percent less for herbicides and 5 percent less for insecticides than in 1983.

Total fertilizer use on field crops is expected to climb 17 percent in 1984, despite an overall rise in fertilizer prices. Farmers will apply an estimated 10.7 million tons of nitrogen, 4.8 million tons of phosphorus, and 5.7 million tons of potash this season. Average farm prices are likely to show a year-to-year gain of 16 percent for nitrogen, 8 percent for phosphorus, and 5 percent for potash. Domestic production and imports of the three plant nutrients should meet anticipated demand.

Agricultural energy demand is projected to rise 10 percent in 1984 as fuel needs expand with the anticipated increase in field crop acreage. Farm energy expenditures likely will rise to $8.4 billion from $7.7 billion in 1983. Farmers can expect average per-gallon prices to hold constant this year at about $1.18 for gasoline, $1.04 for diesel fuel, and $0.77 for LP gas.

FARM MACHINERY

Demand

Demand for farm machinery in 1984 probably will increase over last year. Factors contributing to this outlook include a possible $9- to $16-billion increase in net farm income, an indicated 30 to 35 million PIK-idled acres coming back into production, and a likely improvement in yield prospects following the severe drought last year. However, high interest rates, declining net worth, and low real farm income compared with the 1970's have reduced farmers' borrowing capacity by undermining the value of collateral and by raising concerns about some farmers' ability to repay loans. The weak farmland market is leading many lenders to review borrowers' cash flow more closely.

Expenditures

Farmers are expected to spend about $8.6 billion in 1984 to buy, lease, or rent new and used machinery, up about 9 percent from last year (table 1).

Machinery expenditures peaked at $12 billion in 1979, but since then have declined 34 percent to $7.9 billion in 1983. However, the 6-percent decrease last year was less severe than the 21-percent drop in 1982.

When repairs and maintenance are included with purchases, leasing, and rental, farmers are expected to spend about $13.9 billion on machinery in 1984, up about $1.4 billion over last year (table 2). The 1983 total includes tractor purchases of $2.9 billion, self-propelled combines at $935 million, and other machinery at $3.8 billion. Machinery leasing and rental, and repair and maintenance expenditures were $328 million and $4.6 billion, respectively in 1983. Repair and maintenance outlays have increased steadily since 1977, rising 57 percent by 1982. Leasing and rental expenses, although increasing in recent years, are far less important than either purchases or repairs, and ranged from 2.6 to 2.8 percent of total expenditures in 1982 and 1983.

This year, repair and maintenance expenditures are expected to rise 15 percent to $5.3 billion, mainly because of increased equipment use due to an anticipated increase in planted acreage. Also responsible for the increase is the steady rise in costs of replacement parts and service, in part caused by a 5- to 8-percent per year increase in wage rates.

Unit Sales

Unit sales of farm machinery are expected to rise between 5 and 8 percent in 1984, but sales of self-propelled combines may decline 10 to 15 percent (table 3). Although farm machinery unit sales continued their 4-year decline last year, the decline may be tapering off. From 1979 to 1983, retail unit sales of most machinery items fell 50 percent or more. For example, sales of tractors over 40 horsepower (hp) dropped 49 percent from 139,000 units to 71,000. From 1982 to 1983, unit sales of tractors over 40 hp slipped 8 percent, compared with a 26-percent decline in 1982.

Self-propelled combine unit sales fell 19 percent from 1982 to 1983. Unit sales of both combines and corn heads decreased substantially since the peak year of 1979. Combine sales declined 59 percent from 32,000 units in 1979 to 13,000 in 1983. Sales of corn heads fell 68 percent from 22,000 units to 7,000.

Annual farm purchases of balers producing 200-pound or smaller bales dropped from 19,000 units in 1979 to 9,000 in 1982, but were unchanged in 1983. During the 4-year period, a major shift in farmer preference was underway to units that produce larger bales with these units outselling the smaller-bale units by about 40 percent. Purchases of mower conditioners also declined over the 4 years, and like balers, declines were sharpest in 1980 and 1982, while 1983 purchases were unchanged. Purchases of forage harvesters have fallen sharply since 1979, with annual declines of at least 11 percent per year.

A number of factors have caused farm machinery sales to decline. Farm incomes on average have been trending downward both in actual and real terms. Also, interest rates paid by farmers began climbing sharply after 1979. For example, average Production Credit Association (PCA) interest rates were 10.7 percent in 1979, but jumped to 13.6 percent by 1982 before falling to 12.1 percent in 1983. In addition, tractor and harvesting machinery prices have been rising quite rapidly, at least in the early years of this period, and, finally, the 1983 drought and PIK program reduced machinery requirements.

Table 1.—Farm expenditures for selected production items, 1977 to 1983 and forecast 1984

Year	Farm machinery		Fertilizer and lime	Pesticides	Fuel and lube	Electricity	Seed	Total
	Purchases[1]	Repairs and maintenance						
	Billion dollars							
1977	8.6	2.8	6.3	1.9	4.4	1.0	2.5	27.5
1978	10.8	3.5	6.4	2.7	4.6	1.4	2.6	32.0
1979	12.0	3.7	7.2	3.1	6.3	1.6	3.0	36.9
1980	10.9	4.2	9.5	3.3	7.8	1.8	3.4	40.9
1981	10.6	4.3	9.6	3.6	9.1	2.0	3.9	43.1
1982	8.4	4.4	9.0	3.6	8.8	2.1	4.0	40.3
1983[2]	7.9	4.6	7.6	3.1	7.7	2.3	3.5	36.7
1984[3]	8.6	5.3	8.7	3.6	8.4	2.6	4.3	41.5

[1]Includes leasing and rental. [2]Estimated. [3]Forecast.

Table 2.-Farm machinery expenditures, 1982, 1983,and forecast 1984

Item	1982	1983[1]	1984[2]
		Million dollars	
Purchases:			
Tractors-			
2-wheel drive			
Under 40 hp	491	558	603
40-99 hp	722	724	793
100 hp or more	1,126	1,152	1,318
4-wheel drive	548	443	492
Total	2,887	2,877	3,206
Self-propelled combines	1,160	935	819
Other machinery	4,087	3,760	4,201
Total purchases	8,134	7,572	8,226
Leasing and rental	363	328	360
Repairs and maintenance	4,400	4,600	5,300
Total expenditures	12,897	12,500	13,886

[1]Estimated. [2]Forecast.

Early last year, expectations were that the decline in machinery unit purchases might level off because of improved farm income prospects. A review of 1983 sales data indicates that this did occur in the first half of the year. However, the severe drought reduced purchases beginning in midyear and caused demand to vary by region. During the peak of the drought from June until October, retail sales of 2-wheel drive tractors fell by 8 percent in States affected by the drought, and only 2 percent in States not affected. Self-propelled combine sales fell 19 percent in drought-affected States, but only 6 percent in States not affected. Meanwhile, small tractor sales picked up last year. In 1983, farmers purchased 46,000 tractors under 40 hp, an increase of 4,000 or 10 percent over 1982.

For the first 3 months of 1984, tractor sales were up 5 percent and mower conditioner sales were up 6 percent above the same period in 1983 (table 4). However, unit sales of self-propelled combines, forage harvesters, and balers declined 35 percent, 24 percent, and 7 percent, respectively.

Table 3.—U.S. tractor and harvesting machinery sales, 1979 to 1983, and forecast 1984[1]

Machine type	1979	1980	1981	1982	1983	1984[2]
			Thousand units			
Tractors:						
2-wheel drive-						
Under 40 hp	—	—	—	42	46	49
40-99 hp	65	58	51	41	38	41
100 hp or more	63	50	43	29	28	30
4-wheel drive[3]	11	11	10	7	5	6
Total over 40 hp	139	119	104	77	71	77
Total all tractors	—	—	—	119	117	126
Other machinery:						
Self-propelled combines	32	26	27	16	13	11
Corn heads[4]	22	17	16	9	7	7
Mower conditioners	26	19	19	14	14	15
Balers[5]	19	14	14	9	9	9
Forage harvesters	12	9	8	5	4	4
			Percent change from previous year			
Tractors:						
2-wheel drive-						
Under 40 hp		—	—	—	10	
40-99 hp		−11	−12	−20	−7	
100 hp or more		−21	−14	−33	−3	
4-wheel drive		0	−9	−30	−29	
Total over 40 hp		−14	−13	−26	−8	
Total all tractors		—	—	—	−2	
Other machinery:						
Self-propelled combines		−19	4	−33	−19	
Corn heads		−23	−6	−44	−22	
Mower conditioners		−27	0	−26	0	
Balers		−26	0	−36	0	
Forage harvesters		−25	−11	−38	−20	

— = Not available.

[1]Includes domestically produced and imported tractors sold in the United States. [2]Forecast. [3]With 170 horsepower or more. [4]Attachment sold separately for self-propelled combines. [5]Producing 200-pound or smaller bales.

Source: (3)

Table 4.-U.S. tractor and harvesting machinery sales January to March, 1983 and 1984

Machine type	1983	1984	Change from 1983 to 1984
	Units		*Percent*
Tractors:			
2-wheel drive-			
Under 40 hp	9,086	8,997	−1
40-99 hp	8,258	9,485	15
100 hp or more	5,911	5,831	−1
Total	23,255	24,313	5
4-wheel drive	974	1,198	23
Total	24,229	25,511	5
Other machinery:			
Self-propelled combines	3,106	2,012	−35
Mower conditioners	1,779	1,891	6
Balers	1,231	1,149	−7
Forage harvesters	475	363	−24

Sources: (2, 3).

Changing Machinery Purchase Patterns

During the 1970's, a number of changes took place in the tractor market. Sales of all tractors peaked at 155,000 units with high farm incomes in 1973 (table 5). From then through 1977, net farm income and tractor sales declined. But with rising income, sales peaked again in 1978 and 1979. After 1979, sales continued to drop annually to a low of 71,000 units in 1983.

Total horsepower of tractors purchased in 1982 and 1983 declined to 8 million each year after ranging between 14 and 15 million from 1973 to 1979 (table 5). On average, farmers have been purchasing smaller tractors in recent years. This is in part due to the high purchase price of large horsepower tractors.

Since 1970, tractor sizes changed rather substantially. In 1970, farmers bought 78,000 tractors in the 40 to 99 hp, 2-wheel drive class, compared with 25,000 2-wheel drive tractors rated at 100 hp or more (table 6). Large 4-wheel drive tractors (170 hp or more) were introduced about 1970, but their share of total sales was so small that sales data were not collected. However, in 1971, about 3,000 4-wheel drive tractors were sold. After 1971, sales of large tractors with 100 hp or more rose steadily until the late 1970's, but this trend has been leveling off in the past several years.

Prices

Tractor and other machinery prices are expected to rise about 5 percent in 1984, 1 or 2 percentage points below last year's increase (table 7). Meanwhile, prices of self-propelled combines are forecast to increase only about 3 percent because of the continuing sales slump.

Machinery price hikes outpaced increases for other input items during the 1970's and so far in the 1980's. The price index for tractors and self-propelled machinery rose 4.7 percent from March 1983 to March 1984, and for other machinery by 5.4 percent. By contrast, the price index for all farm production inputs increased only 3.9 percent. As a result, tractors and self-propelled machinery prices rose over 20 percent more, and other machinery items over 38 percent more, than the average of all production items during the past year. Increasing prices, despite reduced purchases, may be attributed to the rising costs of raw materials such as rubber and steel, and higher per unit fixed production costs because of recent low factory operating rates.

Table 5.—U.S. farm tractor sales and size, 1970 to 1984[1]

Year	Tractor sales		Average tractor size	
	Units	Horsepower	Per unit	Change from previous year
	Thousand	*Million*	*Horsepower*	*Percent*
1970	103	9	84	
1971	106	10	92	9
1972	128	12	94	2
1973	155	15	99	5
1974	141	14	102	3
1975	137	15	107	5
1976	136	14	105	−2
1977	131	14	105	*
1978	137	15	108	3
1979	139	15	110	2
1980	119	13	111	1
1981	104	12	111	*
1982	77	8	108	−3
1983	71	8	108	*

* = Less than 0.5 percent.

[1]Wheel tractors with 40 or more horsepower. Tractor sales and horsepower numbers are based on unrounded data and therefore do not coincide with per-unit horsepower numbers.

Source: (3).

Table 6.-U.S. tractor sales by size of unit, 1970-1983

Year	2-wheel drive			4-wheel drive 170 hp or more
	Under 40 hp	40-99 hp	100 hp or more	
		Thousand units		
1970	21	78	25	—
1971	28	70	33	3
1972	33	78	46	4
1973	40	79	71	5
1974	32	66	68	7
1975	22	63	65	9
1976	16	65	61	10
1977	—	63	61	7
1978	—	63	66	8
1979	—	65	63	11
1980	—	58	50	11
1981	—	51	43	10
1982	42	41	29	7
1983	46	38	28	5

— = Not available.

Source: (3).

Supplies

There have been unusually large supplies of most types of farm machinery for the past few years for several reasons. Imports of machinery assembled abroad have increased significantly. At the same time, sales were

declining, and manufacturers did not adjust domestic production rapidly enough to avoid inventory accumulation.

This is perhaps best illustrated by the tractor supply situation for 1982 and 1983. In 1982, U.S. tractor supplies included 246,200 units of which 122,200 or 50 percent were inventories carried over from the previous year, 59,500 units or 24 percent which were domestically produced during the year, and 64,500 units or 26 percent that were imported (table 8). Tractor supplies in 1983 were about 5 percent less than in 1982, with about the same share in inventories (47 percent) but with domestic production declining from 59,500 units to 32,400, a 46-percent drop. Most of the drop was in the 40-99 hp category which declined from 15,000 units to fewer than 500. By contrast, the number of imported units increased from 64,500 to 90,700, a 41-percent rise.

The inability to make timely downward production adjustments has resulted in inventories of tractors and selected types of harvesting machinery that are currently about double normal inventory requirements.

Inventories

Tractor inventories increased between 1978 and 1981-82. Yearend stocks were about the same for 40-99 hp tractors and about twice as great for larger 2-wheel drive tractors in 1983 as in the early and mid-1970's (table 9). However, inventories for 40-99 hp tractors have been declining in the last few years because of major factory production cutbacks, reflecting reduced demand for these tractors.

Table 7.—Indices of U.S. prices paid for farm machinery and all production items, 1972 to 1984

Year[1]	Tractors and self-propelled machinery	Other machinery	All farm production items
		1977 = 100	
1972	54	53	61
1973	58	57	73
1974	68	65	83
1975	82	80	91
1976	91	92	97
1977	100	100	100
1978	109	108	108
1979	122	119	125
1980	136	132	138
1981	152	146	148
1982	165	160	150
1983	174	171	153
1983[1]	172	168	152
1984[1]	180	177	158
		Percent	
Average annual price increase:			
1972 to 1983	11.3	11.3	8.9
1982 to 1983	5.5	6.9	2.0
Price increase:			
March 1983 to 1984	4.7	5.4	3.9

[1]March.

Stocks of large-sized, 2-wheel drive models with 100 hp or more also increased in the late-1970's and early-1980's. However, cutbacks in production accompanied by sales campaigns featuring discounts, rebates, loans with initial interest-free periods, and other promotional activities successfully stabilized stocks. Production is currently running at 40 percent of capacity. This production has not outstripped sales in the past 2 years (table 8), but excessively large inventories are still being carried. Four-wheel drive tractor inventories were quite high several years ago, but have declined more recently. However, compared with sales, inventories of 4-wheel drive tractors are still large.

Combine inventories in the last few years also have been two to three times larger than in the early and mid-1970's (table 10). By contrast, baler and forage harvester inventories began dropping in 1982. Although stocks of most machinery items declined in the last several years, sales dropped faster. Therefore, inventories in relation to sales continued to increase for a year or so and now the rate of accumulation appears to have stabilized, but inventories are still excessive.

Table 8.—U.S. tractor supplies and disposition, 1982 and 1983

Tractor category and item	1982	1983	Change
	Thousand units		*Percent*
Under 40 hp:			
Beginning inventory	42.2	38.9	−8
Production	0	0	0
Imports	39.8	47.3	19
Supply	82.0	86.2	5
Exports	1.1	0.6	−45
Sales	42.0	45.6	8
Ending inventory	38.9	40.0	3
Total disposition	82.0	86.2	5
40-99 hp:			
Beginning inventory	38.5	29.8	−23
Production	15.0	0.4	−97
Imports	20.0	39.5	97
Supply	73.5	69.7	−5
Exports	2.6	1.8	−31
Sales	41.1	38.1	−7
Ending inventory	29.8	29.8	0
Total disposition	73.5	69.7	−5
100 hp or more:			
Beginning inventory	41.5	41.7	1
Production	44.5	32.0	−28
Imports	4.7	3.9	−17
Supply	90.7	77.6	−14
Exports	13.0	8.2	−37
Sales	36.0	33.2	−8
Ending inventory	41.7	36.2	−13
Total disposition	90.7	77.6	−14
All tractors:			
Beginning inventory	122.2	110.4	−10
Production	59.5	32.4	−46
Imports	64.5	90.7	41
Supply	246.2	233.5	−5
Exports	16.7	10.6	−37
Sales	119.1	116.9	−2
Ending inventory	110.4	106.0	−4
Total disposition	246.2	233.5	−5

Sources: (3, 16, 17).

Production and Shipments

Manufacturers have been adjusting domestic production downward during the past several years in response to a depressed machinery market. Tractor production adjustments have varied among the three size categories. Under 40 hp tractors currently are all produced abroad (table 8). The 40-99 hp group is increasingly produced abroad with less than 1 percent domestically assembled in 1983. The 100 hp or more category is still largely domestically manufactured with 95 percent produced in the United States in the past 2 years.

Production trends vary considerably among the three major harvesting machinery types (14). Baler manufacturers have been the most successful in adjusting output downward due to declining demand. Forage harvester sales have not kept pace with output during the past 5 years despite continued production cuts. Self-propelled combine manufacturers also have had large inventories because of declining sales since 1979. Combine manufacturers have been forced to make severe production cuts to better balance supply with demand.

In 1970, U.S. manufacturers' farm machinery shipments were valued at about $2.4 billion (table 11). Total machinery shipments increased in value over the next 9 years, reaching $9.4 billion in 1979. The value then declined by $400 million in 1980, increased by about $500 million in 1981, and dropped $2.1 billion to $7.4 billion in 1982, the lowest level since 1977.

Gradual changes have occurred in machinery purchase patterns. Tractors account for the largest share of machinery shipments, but their share dropped from 38 percent in 1970 to 30 percent in 1982. Manufacturers' shipments of combines and combine attachments, including corn and small grain headers, accounted for 10 percent of total shipments in 1970, but rose to 20 percent in 1982. Shipments of other harvesting machinery remained at about 17 percent of the total during this period. Field machinery was steady at about 20 percent, and other machinery declined from 17 to 14 percent. The value of shipments of most machinery increased by at least 150 percent from 1970 to 1982. The most striking increase has been the seven-fold gain in factory shipments of combines and combine attachments.

Beginning in 1979, the number of large baler units shipped exceeded smaller baler units by more than 40 percent (table 12). In terms of factory shipment values, large-bale machines have been higher since 1978, reflecting higher price per unit of the large-baler.

Table 9.—Inventories of tractors manufactured in North America, 1973 to 1983[1]

Year	2-wheel drive		4-wheel drive,
	40-99 hp	100 hp or more	170 hp or more
	Thousand units		
1973	22	14	*
1974	27	13	2
1975	30	13	3
1976	32	19	5
1977	40	31	6
1978	33	27	4
1979	38	27	6
1980	38	25	7
1981	38	25	7
1982	30	36	5
1983	30	32	4

* = Less than 1,000.

[1]As of December 31 each year, manufacturer, wholesaler, and dealer wheel tractor stocks.

Source: (3).

International Trade

The strength of the U.S. dollar relative to other currencies has made U.S. exports more expensive while making imports cheaper. As a result, the U.S. wheel tractor and harvesting machinery trade balance shifted from a surplus of nearly $278 million in 1982 to a deficit of $93 million in 1983 (table 13).

Canada continues to be our most important machinery trading partner. In 1982, U.S. exports to Canada were $532 million for wheel tractors and harvesting machinery, and imports of these items totaled nearly $273 million. This left the United States with a positive trade balance of $259 million with Canada (table 13). In 1983, machinery trade with Canada declined, but the trade balance remained the same. Considering the United States is the primary North American supplier of farm equipment and the Canadian economy is stable, the U.S. trade balance with Canada should remain positive in 1984.

The United States was a net importer of Japanese wheel tractors in both 1982 and 1983, with imports valued at $148 million and $150 million, respectively. In both years, small wheel tractors under 40 hp accounted for 90 percent of Japanese imports. Japanese farmers have small acreages and low horsepower requirements and are being well served by Japanese farm equipment manufacturers. These manufacturers view small tractors as a good means of entering the U.S. market. Also, many U.S. manufacturers contract with foreign firms to

Table 10.—Inventories for selected types of harvesting machinery manufactured in North America, 1973 to 1983[1]

Year	Self-propelled combines	Balers[2]	Forage harvesters[3]
		Thousand units	
1973	5	14	9
1974	6	19	13
1975	5	15	12
1976	5	17	12
1977	10	19	12
1978	9	17	13
1979	8	13	12
1980	12	14	12
1981	13	14	10
1982	14	12	9
1983	13	8	6

[1]As of December 31 each year, manufacturer, wholesaler, and dealer stocks. [2]Producing bales under 200 lbs. [3]Shear-bar type.

Source: (3).

manufacture and export small wheel tractors to the U.S. The United States sold virtually no tractors or harvesting machinery to Japan in 1982 and 1983. The same trade patterns with Japan are expected to continue in 1984.

The U.S. wheel tractor and harvesting machinery trade balance with the Federal Republic of Germany (FRG), United Kingdom (UK), and France worsened from 1982 to 1983 (table 13). The continuing trend toward more U.S. imports and fewer exports reflects the lower value of their currencies compared with the U.S. dollar, lower foreign production costs, and increased use of U.S.-owned foreign subsidiaries of contracts with foreign manufacturers to supply selected machinery items for U.S. markets.

Trade deficits with the FRG and UK increased by $70 million and $66 million, respectively, from 1982 to 1983. The U.S. trade balance with France fell from a positive $21 million to a deficit of $4 million over the same period (table 13).

Trade with Mexico in wheel tractors and harvesting machinery resulted in a U.S. trade surplus of $75 million in 1982, but a deficit of $13 million in 1983. Mexico's recent financial problems, including the low value of the peso, made U.S. farm equipment too expensive.

Saudi Arabia, in an attempt to become more agriculturally self-sufficient, continues to purchase a substantial number of U.S. wheel tractors and harvesting items, with the 1983 trade balance increasing to about $31 million (table 13).

The North American Farm Machinery Industry

The North American farm machinery industry is a highly concentrated market. There are essentially three types of firms in this industry: full-line, long-line, and short-line. A full-line producer, such as Deere and Company or International Harvester, produces a complete line of tractors and tractor-powered machinery, self-propelled equipment and attachments, and other equipment. Long-line producers are smaller and more specialized and produce a limited number of major items. For example, Steiger Tractor manufactures 4-wheel drive tractors, but not 2-wheel drive tractors. Short-line firms supply machinery used in more regional or specialty agricultural operations.

This discussion focuses on the full-line and long-line producers who account for most of the sales of tractors and harvesting machinery.

Current Industry Structure

There are only a few full-line and long-line producers. Seasonal agricultural production and fluctuations in farm machinery demand appear to favor the established full-line and long-line producers. By offering a complete product line, the full-line manufacturer can spread the risks of demand fluctuations. The seasonal variation also favors the larger firm with extensive capital resources to carry over from peak sales periods to periods when sales values are low. Sales tend to follow fixed patterns. For example, roughly 85 percent of all new equipment sales are made between April and October each year. Average monthly unit sales reported by the Farm and Industrial Equipment Institute for 1979-83 indicate that 60 percent or more of all new tractors (40 and over hp) are sold in this 7-month period (figure 1). Unit sales of 2-wheel drive tractors with 40-99 horsepower peak in April, June, and October, while unit sales of 2-wheel drive tractors over 100 hp and 4-wheel drive tractors over 170 hp peak in April and October.

Unit sales of other machinery items are even more seasonal. Between 1979 and 1983, 54 percent of all new combines were purchased between July and October, while 58 percent of new balers (producing bales weighing

Table 11.—Value of factory shipments from U. S. farm machinery manufacturers, 1970 to 1982[1]

Year	Tractors[2]	Combines and attachments[3]	Other harvesting[4] machinery	Field machinery[5]	Other machinery[6]	Total
			Billion dollars			
1970	0.9	0.2	0.4	0.5	0.4	2.4
1971	0.9	0.3	0.4	0.5	0.4	2.5
1972	1.2	0.3	0.5	0.6	0.5	3.1
1973	1.3	0.4	0.7	0.8	0.7	3.9
1974	1.5	0.6	0.9	1.2	0.9	5.1
1975	2.1	0.7	1.0	1.6	0.9	6.3
1976	2.2	0.9	1.1	1.6	0.9	6.7
1977	2.4	0.9	1.1	1.6	1.1	7.1
1978	2.2	1.1	1.3	1.6	1.4	7.6
1979	2.9	1.3	1.5	2.1	1.6	9.4
1980	2.8	1.4	1.6	1.9	1.3	9.0
1981	3.1	1.8	1.5	1.9	1.2	9.5
1982	2.2	1.5	1.2	1.5	1.0	7.4

[1]Factory shipments of tractors, farm machinery and equipment including parts and attachments produced by original equipment manufacturers. Includes units shipped for export, added to inventories, or sold. Very small firms (generally less than 5 employees) for which 1977 Census of Manufactures data were derived from administrative records of other government agencies are excluded. [2]Includes all farm wheel type tractors. [3]Includes self-propelled and pulled combines, small grain heads and row-type grain heads. [4]Includes all haying equipment and all other harvesting machinery. [5]Includes all other field machinery including tillage, cultivation, spraying, and dusting equipment. [6]Includes livestock handling and feeding, farm elevators, transportation equipment (except trucks), and other machinery used to handle crops.

Source: (14).

Table 12.—Baler shipments by unit and value, 1977 to 1982

Year	Bale size			
	Under 200 lbs.	200 lbs. or more	Under 200 lbs.	200 lbs. or more
	Thousand units		*Million dollars*	
1977	25	18	83	82
1978	23	21	84	113
1979	21	31	85	173
1980	17	32	82	214
1981	16	23	94	178
1982	10	14	68	117

Source: (14).

200 pounds or less) were bought between June and August (figure 2).

Not only are farm machinery purchases highly seasonal but farmers can postpone the purchase of a durable good in anticipation of favorable changes in farm income, interest rates, or machinery prices.

Older firms have developed sufficient capacity to meet market requirements. In addition, they have established a dealer-manufacturer distribution system to which many farmers are loyal. To compete against the existing dealer-manufacturer distribution system, potential market entrants face enormous startup, research and development, and marketing costs.

Financial Status of the Industry

Since 1979, industry earnings (net income) have paralleled declining unit sales of farm equipment with losses experienced by several firms each year. A survey of four leading farm machinery manufacturers reveals that net income declined 183 percent between 1979 and 1983 (table 14). But, annual losses have declined since 1982.

Buoyed by record sales in the late 1970's, manufacturers were slow to respond to declining farm machinery sales in the early 1980's, contributing to the increasingly unfavorable earnings statements. Certain firms had to restructure operations, sell corporate assets, improve management practices, and refinance debt in order to survive. Machinery manufacturers are continuing to reduce output to control production costs and inventories and to increase dealer liquidity.

Prospects for the Industry

The farm machinery industry is in a difficult transition period. As the number of farms continues to decline and the average farm size increases, the overall demand for machinery units will continue to decline. It is not likely that farm machinery sales in North America will again reach the record levels attained in 1979. Demand for certain types of large machinery will be boosted by changes in farm numbers and farm size, but not enough to ensure adequate profit margins for some manufacturers. Some manufacturers probably will produce a narrower line of products and possibly sell, with their brand-name, equipment manufactured by other suppliers. Other long-term possibilities are the establishment of joint ventures or manufacturing agreements between farm machinery manufacturers and foreign producers to supply some products for the U.S. market.

Farm Machinery Distribution In North America

The farm machinery distribution system in North America is based on the independent franchise dealership. This system dates to the pre-tractor era when machinery was sold through retail outlets handling hardware and various other kinds of merchandise. These retail outlets became the norm with the introduction of the tractor and a full line of machinery. Dealers still appear to prefer their independent status (13).

Dealers usually handle one manufacturer's product line exclusively. This is especially true with tractors and combines. However, as machinery sales decline, so may

Figure 1

Monthly Purchases of Selected Tractor Sizes

5- Year Average, 1979 to 1983

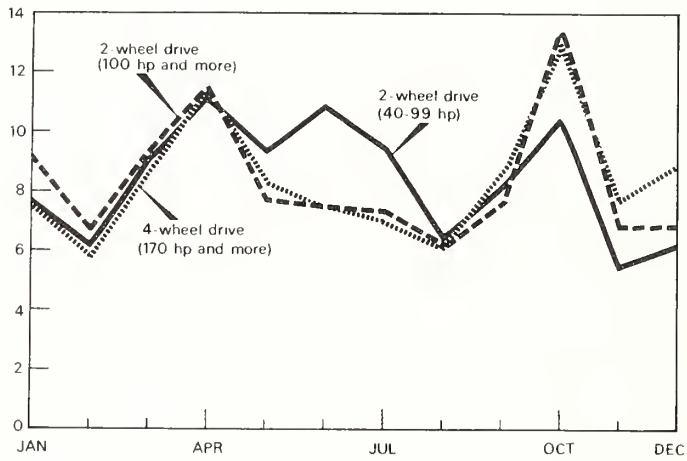
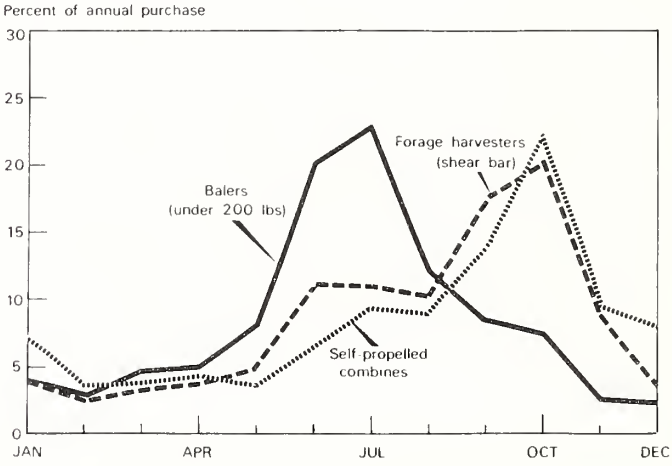


Figure 2

Monthly Purchase of Balers, Forage Harvesters, and Self-Propelled Combines

5-Year Average, 1979 to 1983



the prevalance of one-line product dealers. While manufacturers don't require dealers to carry only one machinery line, they maintain that their success rests on the dealers' ability to give adequate attention to their specific product line. Farmers depend on dealerships not only to carry new and used machines, but also to repair equipment.

Retail Financing

The high cost of major machinery items usually makes machinery financing a necessity. Manufacturers use wholly-owned credit subsidiaries to extend credit to farmers. Usually, these subsidiaries purchase retail installment contracts.

Table 13.—U.S. tractor and harvesting machinery trade, 1982 and 1983[1]

Country, item	Imports		Exports		Trade balance	
	1982	1983	1982	1983	1982	1983
			Million dollars			
Canada:						
Tractors	131	92	373	301	242	209
Harvesting machinery	142	57	159	108	17	51
Total	273	149	532	409	259	260
Federal Republic of Germany:						
Tractors	100	176	*	*	(100)	(176)
Harvesting machinery	13	9	2	4	(11)	(5)
Total	113	185	2	4	(111)	(181)
Japan:						
Tractors	148	150	*	*	(148)	(150)
Harvesting machinery	*	*	2	2	2	2
Total	148	150	2	2	(146)	(148)
Mexico:						
Tractors	*	13	29	*	29	(13)
Harvesting machinery	*	3	46	3	46	0
Total	*	16	75	3	75	(13)
United Kingdom:						
Tractors	39	97	7	5	(32)	(92)
Harvesting machinery	*	*	10	4	10	4
Total	39	97	17	9	(22)	(88)
Saudi Arabia:						
Tractors	—	—	11	25	11	25
Harvesting machinery	—	—	*	6	*	6
Total	—	—	11	31	11	31
France:						
Tractors	5	16	*	1	(5)	(15)
Harvesting machinery	1	2	27	13	26	11
Total	6	18	27	14	21	(4)
Italy:						
Tractors	37	32	*	—	(37)	(32)
Harvesting machinery	1	—	3	2	2	2
Total	38	32	3	2	(35)	(30)
Israel:						
Tractors	—	—	4	4	4	4
Harvesting machinery	—	—	*	*	*	*
Total	—	—	4	4	4	4
Other Countries:						
Tractors	34	14	173	65	139	51
Harvesting machinery	6	7	89	32	83	25
Total	40	21	262	97	222	76
All Countries:						
Tractors	494	590	597	401	103	(189)
Harvesting machinery	163	78	338	174	175	96
Total	657	668	935	575	278	(93)

* = Less than $1 million.

— = None reported.

( ) = Imports exceed export

[1]Fiscal year ending September 30.

Sources: (16, 17).

Data are not available on the extent to which new machinery sales are currently financed by the industry. However, table 15 shows the amount of loan funds supplied by six major farm machinery credit subsidiaries to finance retail farm machinery and equipment sales. For these subsidiaries, loans outstanding and new loans increased 372 percent and 268 percent, respectively, from 1970 to 1983. Nevertheless, the record rise in farm debt and interest rates during the late 1970's and early 1980's caused farmers to delay major capital purchases. This is reflected in the decline in loans outstanding and new loans from 1981 to 1983, the greatest decline in 10 to 12 years.

Dealership Changes

In the 1940's, there were an estimated 35,000 farm equipment dealerships in the United States. The number declined to 17,800 in 1972 and 10,000 in the early 1980's. A recent survey compiled by the Farm Equipment Manufacturers Association of U.S. and Canadian dealers reports that 1,185 dealerships have closed since 1981 (figure 3).

There are several explanations for the decline in dealerships. The trend towards large farms and the growing importance of high quality service and repair departments favor large dealerships. An unpublished study reports that not only are large dealers more equipped to provide better service, but they also benefit from economies of scale (18). The study examined dealerships of typical sizes and concluded the average cost per dollar of sales declined from $1.03 at $500,000 of sales to $0.84 at $3.7 million of sales using 1968 to 1971 costs. Also, better transportation networks have reduced the need for as many dealers.

The depressed farm machinery market also explains why the number of dealerships has dropped. Data from annual surveys conducted by the National Farm and Power Equipment Dealers Association indicate that average dealer before-tax profits decreased to less than 1 percent

Figure 3

Machinery Dealer Closures

By 6-Month Intervals in North America, 1981 to 1983

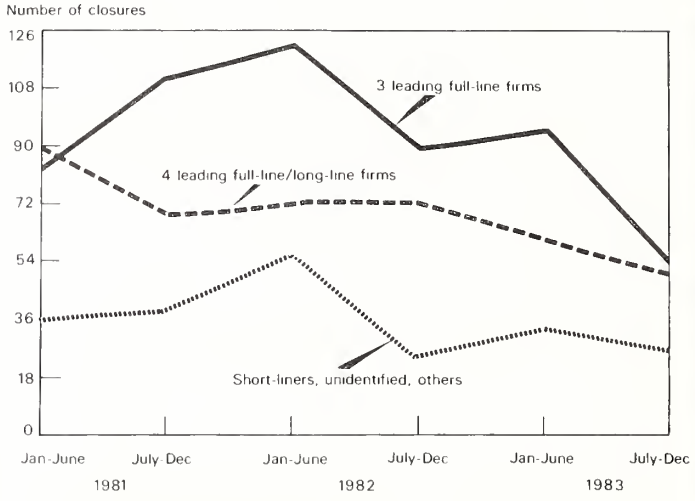


Table 14.—Total sales and earnings for four leading farm machinery manufacturers, 1979 to 1983[1]

Year	Sales	Change	Earnings	Change
	Million dollars	*Percent*	*Million dollars*	*Percent*
1979	16,913		797	
1980	15,873	−6	(347)	−144
1981	16,431	4	(266)	23
1982	12,568	−24	(2,203)	−728
1983	11,410	−9	(662)	70
		Percent		
Total change from 1979 to 1983		−33		−183

[1]Sales and earnings figures represent all divisions of the selected manufacturers. ( ) = Net income loss.

Source: (19).

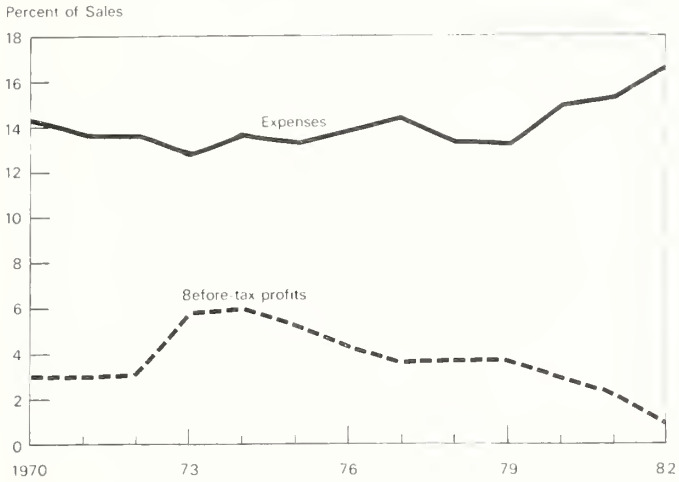
Table 15.—Loan funds supplied by six farm machinery manufacturer credit subsidiaries for U.S. retail farm machinery and equipment sales, 1970 to 1983[1]

Year	Loans outstanding at end of year		New loans made during year	
	Million dollars	*Percent change*	*Million dollars*	*Percent change*
1970	1,170		928	
1971	1,179	0.1	936	0.9
1972	1,499	27.1	1,321	42.0
1973	1,183	−21.1	1,065	−19.9
1974	1,160	−1.9	876	−17.7
1975	1,530	31.9	1,236	41.1
1976	2,192	43.3	1,915	54.9
1977	3,067	39.9	2,682	40.1
1978	3,131	2.1	2,661	−8.1
1979	3,488	11.4	3,133	17.7
1980	4,860	39.3	4,396	40.3
1981	6,129	26.1	4,683	6.5
1982[2]	5,897	−3.8	3,842	−18.0
1983[3]	5,527	−6.3	3,414	−11.1

[1]Excludes loans estimated to have been made for nonfarm purposes. Years shown are company fiscal years: October 31 for four companies, December 31 for the other two. [2]Revised. [3]Estimated.

Figure 4

Machinery Dealer Expense and Profit Trends
1970 to 1982



of sales in 1982, the lowest in 35 years (figure 4). In the mid-1970's, when demand for farm machinery was high, dealer net profits reached 6 percent of sales. Expenses as a percentage of sales increased from 13.2 percent in 1979 to roughly 17 percent in 1982. For 1982, the average dealer realized a 1.4-percent return on total assets and a 5.6-percent return on net worth. In contrast, during the boom of the mid-1970's, dealers earned over 35 percent on net worth.

Finally, changes in dealer-manufacturer relationships may have contributed to increased dealer closure rates. Manufacturers ship machinery to dealerships on a wholesale consignment basis called "floor planning". Under this system, the manufacturer provides the dealer an interest-free period on machinery. Traditionally, the grace period has been 9 to 12 months; however, currently it is 60 to 90 days. A monthly interest charge is assessed the dealer if the machinery is not sold within the specified period.

Dealership Prospects

Future prospects for farm machinery dealers depend in part on the status of farm machinery manufacturers. As manufacturers streamline operations and trim product offerings, some dealerships also may change their market strategy from product diversity to product specialization. This will be especially true of dealers in the major crop producing States, rather than those in dairy regions. Dairy and other livestock producers tend to need a more varied mix of machinery items. Dealers will have to assume a greater role in marketing and financing their products because it will be too costly for manufacturers to market machinery. Used machinery, as well as parts and service departments, should increase as a percentage of annual dealers' total business as farmers' buying preferences change. Marginal dealers will continue to go out of business and more specialized short-line dealerships could grow in importance.

Trends In The Real After-Tax Cost Of Farm Machinery, 1960-1983

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Abstract: For farmers who borrow to finance machinery purchases, interest expenses are an important share of total machinery cost. Real after-tax interest rates have increased sharply since 1979, and have combined with low farm income and higher machinery prices to reduce farm machinery sales.

Keywords: Farm machinery, interest rates, taxes, depreciation, inflation, farm income.

During the early 1970's, there was a large demand for farm machinery due to high farm incomes, low interest rates, and relatively low machinery prices. However, low farm incomes during the last several years have greatly reduced purchases of new farm machinery. Rising farm machinery prices and high interest rates also have contributed to the sales decline. Average farm machinery prices are three times as high as in 1973. After adjustment for inflation and taxes, real interest rates are at their highest level in 25 years.

The two most important factors affecting farm machinery costs are the purchase price of machinery and the real after-tax cost of borrowing funds to make the purchase. Other important factors are the investment tax credits and tax depreciation schedules that determine the tax treatment of machinery purchases. This report reviews the changes that have occurred in these factors over the last two decades and examines their impacts on the total cost of farm machinery ownership.

Farm Machinery Prices

Average farm machinery prices have increased more than fivefold since 1960, primarily because of inflation, but also because of the rising real (inflation-adjusted) costs of producing and distributing machinery. Real changes in machinery prices can be determined by comparing changes in nominal (actual) machinery prices with changes in the general price level. Figure 5 shows the trend exhibited by an index of real machinery prices. Changes in real prices were obtained by subtracting changes in the Consumer Price Index (CPI) from changes in USDA's nominal price index for tractors and self-propelled machinery.

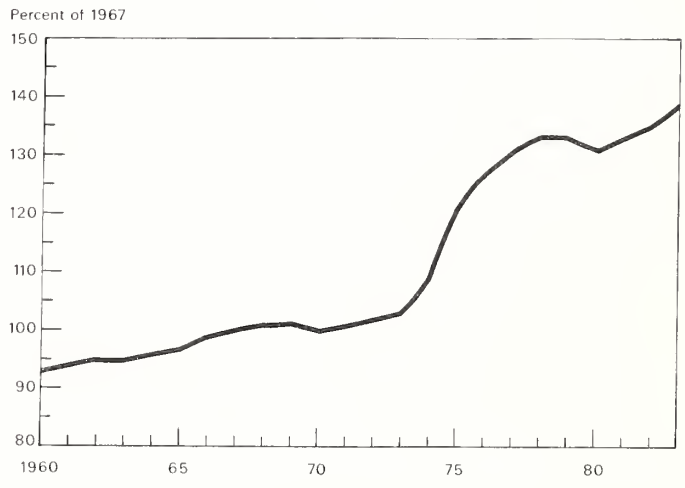
From 1960 to 1973, the nominal machinery price index increased at an average annual compound rate of 4 percent while the CPI rose by an average of more than 3 percent per year. Therefore, the real price of farm machinery advanced by less than 1 percent per year. After 1973, both nominal and real prices for farm machinery began rising much more rapidly. Nominal machinery prices increased by 17 and 21 percent in 1974 and 1975, respectively, while real annual machinery prices climbed by 17 percent over the 2-year period. The real price index peaked in 1979, and declined in 1980, but has since increased at an average rate of 2 percent per year.

Interest Rates

For farmers who borrow to finance machinery purchases, interest expenses are an important share of total ownership costs. Nominal interest rates have increased substantially over the last several decades, primarily because of high inflation. Borrowers benefit from the tax deductibility of nominal interest payments. When this and inflation are taken into account, the real after-tax cost of credit is defined as N(1-T)-I, where N is the nominal interest rate, T is the marginal income tax rate (tax bracket) of the borrower, and I is the rate of inflation. As an example, assume the interest rate is 12 percent, the inflation rate is 6 percent, and the borrower is in the 25-percent income tax bracket. The borrower

Figure 5

Real Prices for Farm Machinery



receives tax deductions for interest payments that offset one-fourth or 3 percentage points of the interest cost. In addition, each year's inflation reduces the real value of the borrower's debt by 6 percent. The real after-tax interest rate is thus 12 x (1-.25) - 6, or 3 percent.

Figure 6 shows how nominal and real after-tax interest rates and inflation have changed over the last two decades. The nominal interest rates are those charged by Production Credit Associations (PCA's) and are typical of rates paid by farmers for farm machinery loans. Most PCA loans carry variable interest rates that frequently change. In contrast, most banks charge fixed interest rates over the life of a loan.

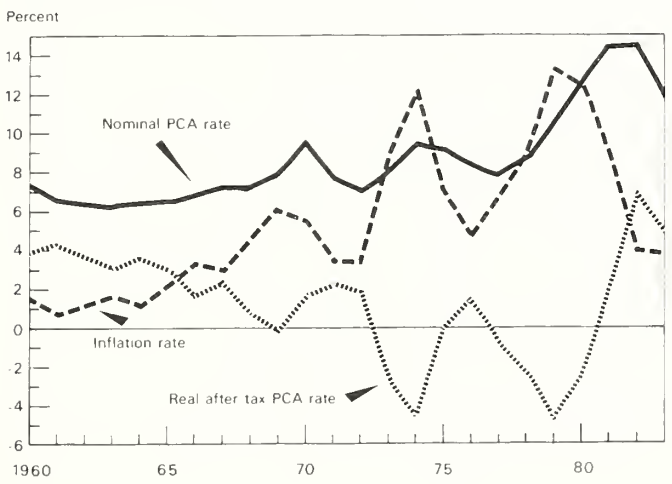
The inflation rates in figure 6 are based on December-to-December changes in the CPI. Real after-tax PCA interest rates were computed for farm borrowers in the 25-percent Federal income tax bracket, which currently applies to married couples with taxable incomes of $25,000 to $30,000. A large portion of today's farmers have incomes within or near this range.

Figure 6 illustrates how inflation affects nominal interest rates. Both inflation and interest rates have displayed upward trends over the last several decades. The trends were relatively stable in the 1960's, but have shown much more variability since 1970. Peaks in the inflation rate in 1969, 1974, and 1979 either preceded or coincided with peaks in nominal interest rates. The 1983 decline in interest rates is partly attributable to the sharp decline in the inflation rate from 1980 to 1983.

Changes in real interest rates are often the result of lags in the adjustment of nominal interest rates to changes in the rate of inflation. During the 1960's, nominal PCA interest rates remained relatively stable while the inflation rate rose from 1 to 6 percent. As a result, the real after-tax PCA interest rate declined, and reached zero in 1969. Since 1970, real interest rates have shown increased variability, reflecting the wide swings in nominal interest rates and the rate of inflation. In two instances, 1973-74 and 1978-79, the inflation rate surged past the slowly adjusting nominal PCA interest rate and pushed the real after-tax PCA rate well below zero.

Figure 6

PCA Interest Rates and Inflation



Since 1979, real rates of interest have increased substantially. The inflation rate peaked at 13 percent in 1979 and dropped sharply to 4 percent in 1982. Over the same period, the nominal PCA interest rate rose from 10.6 to 14.6 percent. As a result, the real after-tax interest rate increased by more than 11 percentage points, reaching a high of nearly 7 percent in 1982.

Tax Depreciation and Tax Credits

The after-tax cost of owning farm machinery is affected by investment tax credits and the tax depreciation methods that are used to write off the cost of farm machinery. Over the last several decades, Congress has made a number of changes in tax credits and tax depreciation policy. Most of the changes have reduced tax burdens and increased incentives for purchasing farm machinery, equipment, and other depreciable assets.

Tax write-off schedules determine the timing of the depreciation deductions that can be claimed by machinery buyers. Buyers often prefer that the deductions be concentrated in the purchase year and years immediately following, so that the tax savings can be obtained as soon as possible. Large first-year tax deductions are an advantage to farmers who buy machinery in high-income years since the deductions are worth more when the buyer is in a high tax bracket.

Prior to 1962, the write-off period for most types of farm machinery was 15 years. Current law allows buyers to use a 5-year write-off schedule that generates tax savings much more quickly.

The investment tax credit provides machinery buyers with a direct tax rebate in the purchase year. Since 1975, buyers have been eligible for an investment tax credit equal to 10 percent of the machinery cost. The tax credit and the short 5-year write-off period tend to lower the after-tax cost of owning farm machinery.

Total Machinery Cost

The total cost of owning farm machinery is a function of the real purchase price, the real after-tax interest rate, and the tax treatment of machinery purchases. Figure 7 shows an index of the real after-tax cost of machinery. The index is a function of the real machinery price index (figure 5), the real after-tax PCA interest rate (figure 6), and the value of tax depreciation deductions and investment tax credits.

The real after-tax cost index is a measure of the real return that farm machinery must generate to provide its owner with sufficient after-tax income to pay the principal and interest on a loan for the full purchase price of the machinery. A higher purchase price or interest rate or less favorable tax treatment raises the cost of owning machinery and thus increases the income that must be earned to break even or make a profit on a machinery purchase.

The cost index shown in figure 7 closely matches the pattern of changes in the real after-tax PCA interest rate in figure 6, with the exception that the cost index exhibited a stronger upward trend in the 1970's. The matching patterns illustrate that interest rates are an important

determinant of total machinery cost. The strong upward trend in the cost index in the 1970's reflects the rise in the real price index for farm machinery over the same period (figure 5).

The cost index doubled from 1979 to 1982, primarily because of the very sharp increase in the real after-tax interest rate. Last year, the index declined slightly as a drop in the real interest rate more than offset a 3-percent increase in real machinery prices.

Nominal prices for farm machinery are expected to increase 5 to 8 percent in 1984. Nominal PCA interest rates probably will average between 12 and 12.5 percent and the CPI is forecast to rise 4 to 6 percent. If the inflation rate is held to 4 percent, the real after-tax PCA interest rate could remain stable, and real machinery prices could rise by several percentage points. A 6-percent inflation rate could drop the real after-tax PCA interest rate to as little as 3 percent, and the net result could be a 10-percent decline in the real after-tax cost of farm machinery.

Farm Income, Machinery Cost, And Tractor Sales

Figure 7 shows the relationship between farm income, the real after-tax cost of farm machinery, and tractor sales. The index of tractor sales was computed from data on the real value of tractor purchases. The farm income index was computed from estimates of the real net farm income of farm operators.

The farm income and tractor sales indices follow a similar pattern while the real after-tax machinery cost index is the opposite (figure 7). This appears to support the thesis that farm income and after-tax machinery costs are important determinants of machinery purchases. High machinery sales in 1973 and 1974 coincide with record farm income in 1973 and a sharp drop in real after-tax machinery costs. From 1974 to 1976, tractor sales dropped because of declining farm income, high tractor prices, and a steep increase in the real after-tax machinery cost. Sales rebounded in 1978 and 1979 as farm income increased and the after-tax machinery cost fell. Since 1979, tractor sales have declined in response to lower farm income, higher tractor prices, and a very rapid and steep climb in the after-tax machinery cost.

Real net farm income in 1983 probably was lower than in any other year since 1960. A recovery is expected in 1984. An increase in farm income could be accompanied by a drop in real after-tax interest rates, with both contributing to an increased demand for machinery.

PESTICIDES

Demand

U.S. demand for pesticides will increase significantly this growing season, primarily in response to an indicated 11-percent rise from 1983 in acres planted to the 10 major field crops. Most of the pesticide increase will be used on acres planted to the five crops included in last year's PIK program (corn, cotton, grain sorghum, rice, and wheat). A 3-percent rise in soybean acreage and a 22-percent drop in barley and oat acreage are anticipated as well.

Planted acres for the major field crops are indicated to total 284 million this season (table 16). Actual planted acreage may differ from intentions depending on market conditions, weather, and farmer participation in the acreage reduction program included in the Agricultural Programs Adjustment Act of 1984. Farm pesticide use will depend on actual acres planted and the extent and intensity of pest problems during the growing season.

Farmers are expected to apply about 440 million pounds active ingredient (a.i.) of herbicides, 67 million pounds (a.i.) of insecticides, and 7 million pounds (a.i.) of fungicides to field crops in 1984 (table 16). Approximately 80 to 90 percent of the total demand for each pesticide category is accounted for by five field crops.

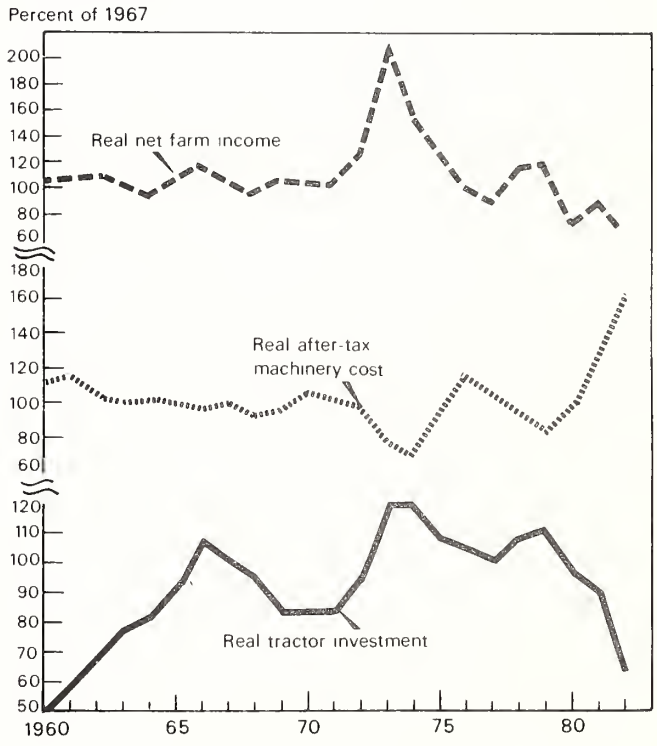
Corn and soybeans will comprise about 56 and 27 percent, respectively, of the total field crop herbicide demand in 1984. These crops also will account for about 45 and 16 percent, respectively, of the total insecticide demand, with cotton accounting for another 25 percent. Peanuts should comprise 75 percent of the fungicide use, followed by wheat at 14 percent.

Pest populations from one year to the next are influenced by several environmental and agronomic factors as well as by farmers' pest control practices. The severity of weed infestations this season will depend on how well farmers controlled weeds on their PIK acreage last year.

Figure 7

Real Net Farm Income

After-Tax Machinery Cost, and Tractor Investment



Farmers who maintained their weed control practices on idled acreage in 1983 should not experience above-average weed pressure this season, but those who didn't may have increased weed problems for several years. For instance, perennial and annual grasses, especially foxtail, are expected to be more severe this year on PIK acreage where infestations were not controlled in 1983.

Although virtually all corn, cotton, and soybean farmers and a substantial proportion of grain sorghum and wheat farmers apply either preplant or preemergence herbicides, some farmers may not get sufficient early-season weed control on last year's idled acreage. Farmers should scout their fields more closely this season for weed problems, as there may be a need to supplement early-season herbicide applications with postemergence herbicides and mechanical cultivation to achieve effective weed control.

Insect and disease problems are more difficult to assess. Some entomologists expect insect infestations to be more severe this season on crop acreage idled last year. If corn rootworm beetles were present in idled fields last year where either foxtail or volunteer corn was pollinating, there is an increased likelihood of a problem with rootworm larvae this year. On the other hand, extended periods of cold, wet weather in the north-central and southern growing regions during the winter and so far this spring may have reduced some overwintering populations and destroyed insect eggs.

Currently, it is not possible to assess the effects of the PIK program and the cool, moist weather on insect problems and insecticide demand this season. Pesticide manufacturers and dealers have increased their advertising this spring to encourage farmers to use soil insecticides on acreage idled in 1983. Before deciding to apply a preventative soil insecticide, farmers should seek professional advice and consider several factors. These include previous insect problems, acreage utilization last season, this year's crop and tillage plans, and soil and weather conditions.

Supplies

Major pesticides are in sufficient supply throughout the market system to meet expected farm demand in the major producing regions during 1984. Some spot shortages of herbicides that were recently registered or marketed in new formulations have been reported in the Corn Belt. These shortages, however, do not pose any specific problems for farmers in the affected local markets.

Most pesticide distributors and retailers have increased their inventories to meet the anticipated rise in pesticide demand as last year's PIK acreage goes back into production. Unless weed and insect infestations are severe in large portions of the major field crop producing regions, on-hand inventories should fulfill this season's expected demand.

Prices

Pesticide prices will be down this growing season after modest annual increases in recent years. Competition among manufacturers and lower feedstock costs have led to price declines for several major herbicides and insecticides. Some firms apparently perceive that increased demand affords an opportunity to expand their market share for this and future seasons. Also, the product patent for trifluralin, the fourth leading field crop herbicide, expires next year. The manufacturer of this herbicide has lowered its price substantially during the last 2 years to improve its market position prior to the patent expiration.

The average herbicide price paid by U.S. field crop farmers is projected to decline more than 7 percent from 1983 (table 17). The composite herbicide price is expected to drop from $4.53 per pound (a.i.) to about $4.20 this season. The overall drop is due to price declines of 11 percent for atrazine, 12 percent for trifluralin, and 9 percent for 2,4-D. These three materials are expected to account for 29 percent of the total field crop herbicide

Table 16.—Pesticide demand by U.S. field crop farmers, 1984

Crops	Planted acres 1983	Planted acres 1984[1]	Herbicides	Insecticides	Fungicides
	Million		*Million pounds (a.i.)*[2]		
Row:					
Corn	60.2	81.8	244.0	30.2	0.07
Cotton	8.0	10.8	17.2	16.8	0.18
Grain sorghum	11.8	14.8	14.7	2.4	0
Peanuts	1.4	1.4	5.2	1.1	5.10
Soybeans	63.5	65.2	119.9	10.5	0.07
Tobacco	0.8	0.8	1.3	3.1	0.40
Total	145.7	174.8	402.3	64.1	5.82
Small grains:					
Barley and oats	30.9	24.2	6.0	0.2	0
Rice	2.2	2.8	12.6	0.5	0.07
Wheat	76.8	82.6	16.7	2.3	0.93
Total	109.9	109.6	35.3	3.0	1.00
Total	255.6	284.4	437.6	67.1	6.82

[1]Based on a recent planting intentions report prepared by the Statistical Reporting Service, USDA. [2]Active ingredients.

Table 17.—U.S. average farm retail pesticide prices for March 1982, 1983, and 1984[1]

Pesticides	Price per pound (a.i.)[2] 1982	1983	1984	Change from 1983 to 1984
	Dollars			*Percent*
Herbicides:				
Alachlor	4.66	4.88	5.10	4.5
Atrazine	2.80	2.45	2.19	−10.6
Butylate+	3.31	3.22	3.34	3.7
Trifluralin	8.50	7.80	6.90	−11.5
2,4-D	2.87	2.71	2.46	−9.2
Composite[3]	4.59	4.53	4.21	−7.1
Insecticides:				
Carbaryl	3.46	3.60	3.70	2.8
Carbofuran	9.36	9.88	10.09	2.1
Methyl parathion	2.59	2.66	2.88	8.3
Synthetic pyrethroids	68.00	66.00	55.20	−16.4
Composite[3]	10.10	10.26	9.72	−5.3

[1]Based on a recent survey of pesticide retailers conducted by the Statistical Reporting Service, USDA and other sources. [2]Active ingredients. [3]Includes above materials and other major materials not listed

market in 1984. Prices for two other major herbicides, alachlor and butylate+, are projected to increase about 4 percent.

The composite retail price for insecticides used on field crops should decline just over 5 percent this season, from $10.26 to about $9.70 per pound (a.i.). Farmers can expect prices of most major insecticides to remain constant or fall slightly from last year's levels. Prices for some insecticides like carbaryl, carbofuran, and methyl parathion, will rise this season, but only marginally. Corn farmers will benefit the most from lower insecticide prices because prices of most major corn rootworm and soil insect materials are holding steady or declining.

Regulatory Actions

Ethylene dibromide - On March 2, 1984, the Environmental Protection Agency (EPA) announced a decision to continue some quarantine uses of ethylene dibromide (EDB) on fruits and vegetables. EPA proposed temporary tolerance levels for citrus and papaya of 250 parts per billion (ppb) for whole fruit and 30 ppb for pulp. These tolerance levels will be revoked on September 1 and the use of EDB on domestic citrus and papaya will then be cancelled. Shippers will be allowed to use EDB on products to be exported if importing countries require its use for quarantine purposes.

On February 3, 1984, EPA suspended the use of EDB on stored grain and milling machinery. This action means that EDB can no longer be sold for use on stored grain or milling machinery. On April 23, EPA published a notice in the Federal Register finalizing the tolerance level for raw grain at 900 ppb. Also, the Food and Drug Administration has indicated that it will immediately begin enforcing the action levels for intermediate and finished grain products.

Dicofol - On March 21, 1984, EPA published a notice in the Federal Register announcing the initiation of a special review of all pesticide products containing dicofol. EPA has determined that dicofol products contain DDT-related compounds and that these compounds pose the same risk to the environment as did DDT.

Dicofol, a miticide, is used primarily on citrus and, in the Western States, on cotton. In a 1977 USDA survey, farmers reported using 485,000 pounds (a.i.) of dicofol on citrus and in a 1979 survey, 440,000 pounds on cotton.

Registrants and other interested parties have until May 7, 1984, to submit data to EPA rebutting the presumed risk of dicofol. If the presumption is not rebutted and the Agency cannot resolve the risk issues through voluntary action by registrants, a benefit-risk study will be conducted to evaluate the continued use of dicofol and propose regulatory options.

Strychnine - On October 19, 1983, EPA published a regulatory action in the Federal Register on the pesticide strychnine. Strychnine is used to control rodents, other small mammals, and birds on a variety of agricultural and nonagricultural sites. EPA reviewed all outdoor, above-ground uses of strychnine because of the potential hazard to nontarget (including endangered) species either by direct or indirect poisoning.

The following summarizes EPA's strychnine decision:

1. Cancel use on:
   a. Rangeland, pasture, and cropland for control of: Prairie dogs, deer mice, meadow mice, chipmunks, and marmots/woodchucks.
   b. Nonagricultural sites for control of: Prairie dogs, deer mice, meadow mice, chipmunks, kangaroo rats, cotton rats, mountain beavers, and opossums.
2. Require label modification for use on:
   a. Rangeland, pasture, and cropland for control of: Ground squirrels, jackrabbits, kangaroo rats, and cotton rats.
   b. Nonagricultural sites for control of: Ground squirrels, marmots/woodchucks, jackrabbits, and porcupines.
   c. Cropland and nonagricultural sites for control of birds.
3. Require efficacy testing so that the lowest bait concentration can be determined for ground squirrel control.

The proposed label modifications are very detailed by use site, but in general contain the following:

1. Do not expose bait to nontarget species and exercise care in the placement and quantities of bait used.
2. Pick up and burn or bury all carcasses.
3. Pick up and dispose of spilled or unused bait.

Registrants have requested a hearing and EPA has appointed an administrative law judge. A prehearing conference was held on April 4, 1984, to determine which use sites would be included in the cancellation hearings.

FERTILIZER

Use

Fertilizer use is expected to increase in 1983/84, primarily because of a return to crop production of PIK-diverted acres. A prospective 11-percent increase in planted acreage with a 36-percent rise in corn acres is expected to boost plant nutrient use 17 percent to about 21.3 million tons. Total nitrogen use for the year is likely to climb to about 10.7 million tons, while phosphate and potash use are expected to rise to about 4.8 and 5.7 million tons, respectively. However, substantially higher prices for nitrogen fertilizer (up 16 percent from March 1983 for anhydrous ammonia) could induce farmers to reduce per-acre nitrogen fertilizer application rates.

Supplies

Domestic supplies of phosphate and potash are expected to be adequate for the 1983/84 fertilizer year, and supplies of nitrogen should also match anticipated use. Nitrogen fertilizer supplies at the end of January 1984 were up 7 percent from 1983, while phosphate and potash supplies were up 28 and 6 percent, respectively (table 18).

Production

Nitrogen fertilizer production in the first 7 months of 1983/84 about equaled year-earlier levels (table 18). However, during the latter part of 1983 and early in

Table 18.—U.S. fertilizer suppliers, 1982/83 and 1983/84[1]

Item	1982/83	1983/84	Change
	Million short tons		*Percent*
Beginning inventories:			
Nitrogen	2.07	2.00	−3
Phosphate (P_2O_5)[2]	.68	.67	−1
Potash (K_2O)	.57	.46	−19
Production:			
Nitrogen	6.70	6.73	0
Phosphate (P_2O_5)[2]	5.20	6.10	17
Potash (K_2O)	1.14	.88	−23
Imports:			
Nitrogen	1.53	2.08	36
Phosphate (P_2O_5)[2]	.07	.06	−14
Potash (K_2O)	2.55	2.92	15
Exports:			
Nitrogen	1.25	1.15	−8
Phosphate (P_2O_5)[2]	2.41	2.30	−5
Potash (K_2O)	.49	.28	−43
Domestic supply:			
Nitrogen	9.05	9.66	7
Phosphate (P_2O_5)[2]	3.54	4.53	28
Potash (K_2O)	3.77	3.98	6

[1]Data for July through January for the fertilizer year starting July 1.
[2]Does not include phosphate rock.

Sources: (1,2,3,4).

1984, output increased in response to rising prices caused by higher-than-normal seasonal demand. As a result, some plants that shut down last year because of low prices and operating losses reopened. Should production maintain its January pace until June, output will be up about 10 percent from 1982/83. Phosphate production during the first 7 months of 1983/84 was 17 percent larger than a year earlier, and appears more than adequate to meet projected domestic and export requirements.

U.S. potash production was down by 23 percent during the first 7 months of the 1983/84 season. This decrease stimulated a 15-percent increase in imports.

Trade

The early-1984 surge in domestic nitrogen fertilizer production may cause nitrogen fertilizer imports to be smaller than earlier expected. However, imports for the year could nevertheless be up about 15 percent from 1982/83's 2.8 million tons. Improved world economic conditions could strengthen export demand for phosphate fertilizers, especially for diammonium phosphate.

Nitrogen

During July-January 1983/84, total nitrogen imports, at 2.1 million tons, were 36 percent ahead of a year earlier (table 18). Anhydrous ammonia imports were up about 47 percent to about 1.76 million tons of material, while urea imports increased by 8 percent to 924,000 tons. These two products accounted for about 90 percent of total nitrogen imports.

Canada was the major supplier of both anhydrous ammonia and urea imports, while the Soviet Union ranked second. Mexico and Trinidad-Tobago also were important suppliers of nitrogen fertilizer imports.

Nitrogen exports during July-December 1983 were 12 percent below a year earlier. In January, exports increased substantially with the result that for the first 7 months of the fertilizer year, exports were down only 8 percent. However, this pace is not expected to continue and exports could drop 10 percent for the entire year. At the end of January, anhydrous ammonia, ammonia nitrate, and urea exports were more than 20 percent below a year earlier. However, a 38-percent increase in ammonium sulfate exports and an 8-percent increase in diammonium phosphate exports partially offset the loss.

Phosphate and Potash

Total exports of processed phosphate materials fell 5 percent during July-January 1983/84, led by a 23-percent drop in phosphoric acid exports and a 27-percent decline in exports of triple superphosphate.

Reduced shipments to India, Venezuela, and Brazil accounted for most of the drop in phosphoric acid exports. Shipments of triple superphosphate to Indonesia, Venezuela, Brazil, the Federal Republic of Germany, Poland, and New Zealand declined the most. Diammonium phosphate exports to Turkey, India, and Taiwan showed substantial gains, but these were offset by smaller shipments to Brazil, Belgium-Luxembourg, France, Italy, and the Republic of Korea.

Potash imports in early 1983/84 were 15 percent ahead of a year earlier (table 18). Canada remained the principal supplier, providing about 89 percent of the total.

Prices

Fertilizer prices in 1983/84 could be up about 9 percent from depressed year-earlier levels, with nitrogen prices advancing the most. Nitrogen prices could rise 12 to 14 percent, phosphate prices, 8 percent, and potash less than 5 percent.

Prices for many fertilizer materials rose during October-December 1983. Anhydrous ammonia, diammonium phosphate, triple superphosphate, and potash prices rose between 2 and 3 percent. Ammonium nitrate prices rose between 1 and 2 percent, while urea prices were unchanged.

Fertilizer prices advanced at a faster pace in early 1984, with nitrogen, phosphate, and potash all posting December-March gains (table 19). Also, March prices of nitrogen and phosphate topped year-earlier levels, while potash prices were about the same. Anhydrous ammonia showed the largest year-to-year gain (16 percent) followed by diammonium phosphate (9 percent) and triple superphosphate (7 percent).

March farm prices followed earlier wholesale price increases. Gulf f.o.b. anhydrous ammonia prices rose from $140 per ton in March 1983 to about $185 in early 1984, while urea prices increased from about $130 to $175. Wholesale prices of ammonium nitrate, ammonium sulfate, and nitrogen solutions advanced by lesser

amounts. Florida wholesale prices for triple superphosphate and diammonium phosphate turned up in September 1983, but prices stabilized in early 1984. Potash prices have shown little movement.

ENERGY

Agricultural Prospects

Farm energy use in 1984 is expected to increase about 10 percent over 1983 as PIK acreage diverted last year is returned to production, and as normal harvesting fuel needs rise from last year's drought-reduced requirements. Farmers' expenditures for fuel and lubricating oil are projected at about $8.4 billion, compared with an estimated $7.7 billion last year (table 1). This reverses a downward trend since 1981 when farm fuel and oil lubricating expenditures peaked at $9.1 billion.

Farm prices of gasoline, diesel fuel, and LP gas are expected to be mostly unchanged for the remainder of 1984 and supplies should be adequate. First-quarter prices reported by farmers averaged $1.18 per gallon for all grades of gasoline, $1.04 for diesel fuel, and $.77 for LP gas (table 20). Average farm gasoline and diesel fuel prices are down substantially from their 1981 peaks of $1.29 for bulk delivered gasoline and $1.16 for diesel fuel. Electricity prices to nonindustrial consumers are expected to average about 4 percent higher in 1984 than last year.

Unusually cold weather early in the winter of 1983-84 put some upward pressure on fuel oil and distillate prices. Farmers reported first-quarter 1984 diesel fuel prices at $1.02 a gallon, 1 cent above fourth-quarter 1983. Farm gasoline prices for the remainder of 1984 are expected to average about $1.18-$1.20 per gallon, whereas LP gas prices may average about $.74-$.76 per gallon.

U.S. and World Situation

Total U.S. petroleum demand in 1984 is expected to increase on an annual basis for the first time since 1978. Consumption likely will exceed last year's by 3 or 4 percent. While the turnaround in demand is significant, 1984 and first-half 1985 demand for petroleum and natural gas still is expected to be about 2 percent below use in 1981 (3).

Increased U.S. energy requirements likely will be met by greater imports, with 1984 domestic crude oil production in the lower 48 States expected to be about the same as last year. Net U.S. imports for 1984 may increase about 24 percent over last year and account for about one-third of our total supply of petroleum (table 21).

With the worldwide economic recovery, OPEC crude oil prices, set at $29 per barrel in March 1983, are expected to hold. Oil consumption in the world market economies (excluding communist countries) is projected to increase in 1984 for the first time since 1979. Demand in the developing countries also is expected to be up in 1984. World consumption probably will be about 2 percent greater than last year. However, current production should be adequate, and no appreciable rise in world oil prices is anticipated.

Rising natural gas prices continue to concern U.S. nitrogen fertilizer producers. Natural gas now accounts for over three-fourths of the cost of producing ammonia. Rising natural gas prices have made U.S. producers increasingly less competitive with foreign producers that have low-cost natural gas supplies because of a lack of competing uses for their gas. The nitrogen trade balance continues to shift away from the United States. Net nitrogen imports during July-January 1983/84 were more than triple a year earlier—930,000 tons, compared with 280,000 tons in 1982/83.

Impact of a Possible Petroleum Supply Disruption

Recent developments in the Iran-Iraq war have heightened concern about a possible interruption of oil shipments through the Strait of Hormuz. About 20 percent of the free world's oil supply flows through the Strait. Although U.S. dependence on oil moving through the Strait has been relatively modest in recent years (8 percent of oil consumed in 1981 and 5 percent in 1982), the dependence of U.S. allies is much greater. For example, 29 percent of the oil consumed by Western Europe and nearly 56 percent consumed by Japan come through the Strait of Hormuz.

In spite of the United States' relatively low dependence on Persian Gulf oil, U.S. industries would be affected in two ways should an extended interruption of oil shipments through the Strait occur. First, the United States

Table 19.—Average U.S. farm prices paid for selected fertilizer materials, 1982 to 1984 [1]

Year	Anhydrous ammonia (82%)	Triple superphosphate (44-46%)	Diammonium phosphate (18-46-0%)	Potash (60%)	Mixed fertilizer (6-24-24%)
			Dollars per short ton		
1981: March	243	248	287	152	221
1982: March	255	230	267	155	219
1983: March	237	214	249	143	205
May	237	214	249	143	206
October	226	205	238	128	196
December	232	210	245	131	198
1984: March	275	229	271	144	212

[1] Based on a recent survey of fertilizer dealers conducted by the Statistical Reporting Service, USDA.

Table 20.—Average U.S. farm gasoline, diesel fuel, and LP gas prices, 1977 to 1984[1]

Period	Gasoline[2]	Diesel fuel	LP gas
	Dollars per gallon		
1977	.57	.45	.39
1978	.60	.46	.40
1979	.80	.68	.44
1980	1.15	.99	.62
1981	1.29	1.16	.70
1982	1.23	1.11	.71
1983	1.18	1.00	.77
1984			
I	1.18	1.02	.77
II[3]	1.19	1.03	.76
III[3]	1.20	1.02	.75
IV[3]	1.18	1.03	.74

[1]Bulk delivered. [2]Average for all grades. [3]Projected using reported first-quarter farm prices as reported in Agricultural Prices, SRS, USDA and percentage changes projected by Department of Energy, Energy Information Administration, for gasoline and number 2 heating fuel (for diesel fuel and LP gas).

would have to compete with other countries for reduced oil supplies in the world market and second, the United States has an obligation, as a member of the International Energy Agency, to share its available supplies with other member countries in case of an oil supply crisis.

If an extended interruption occurred, oil prices could rise significantly. The U.S. Department of Energy estimates that oil prices would increase 50 percent or more if the Strait were closed for a year. A recent Department of Commerce report indicates that a 50-percent jump in petroleum prices would result over time in a 5-percent increase in the price of agricultural products (other than livestock). However, such an impact would not occur in the year of production, if crops had already been planted, leaving the interaction of supply and demand, not input prices, to determine commodity prices. In subsequent years, farmers could include higher input prices in their production decisions and thus higher fuel prices would ultimately affect farm commodity prices.

Proposed Change in Leaded Gasoline Standard

The Environmental Protection Agency (EPA) is considering a proposal to reduce the amount of lead permitted in leaded gasoline from 1.1 grams per gallon to 0.1 gram, or to eliminate lead entirely by 1988. EPA estimates that this action would reduce maintenance costs for many newer engines, eliminate misfueling (putting leaded gasoline in vehicles designed for unleaded gasoline), and improve the health of the population, especially children. EPA estimates that the annual net benefits to society in 1988 would be $786 million (in 1983 dollars) plus unmeasured health benefits if the low-lead option is chosen, and $704 million plus health benefits if all lead is eliminated from gasoline.

However, the proposed lead restrictions would increase the cost of manufacturing gasoline. And, if all lead was removed, would cause excessive wear in certain older engines, including many used in farm equipment, since lead builds up on valve seats and acts as a lubricant.

While virtually all wheel tractors, combines, and many other types of farm equipment manufactured today are diesel powered, a large number of gasoline-powered units still are used on farms and will be for many years if leaded fuel is available. There are an estimated 1.7 million gasoline-powered tractors and 308,000 gasoline-powered self-propelled combines now on farms. More than 1 million gasoline-powered tractors and 200,000 gasoline-powered combines probably will be used on farms in 1988. In addition, some 110,000 to 165,000 other gasoline-powered machines (such as windrowers, cotton-pickers, and sprayers) will be operated on farms in 1988. Most gasoline-powered tractors and combines are relatively small and many no longer operate under heavy load conditions. The heavy tasks now are performed by larger diesel-powered units.

The effects of the proposed EPA action depend upon which option is chosen and the characteristics and use of gasoline-powered tractors, combines, and other equipment. A number of equipment manufacturers, farm machinery trade associations, and USDA engineers were contacted to assess the impacts of these options. The general consensus is that gasoline containing 0.1 gram of lead per gallon probably will not cause excessive engine wear. Also, unleaded fuels are not likely to cause significant wear if engines are not operated under heavy load conditions. Some engines will not be harmed because they were built with cylinder heads that do not need lead for lubrication. Other engines not designed to use unleaded fuel and operated under heavy load conditions could be retrofitted with an LP gas head that does not require lead or lubrication. Otherwise the engines may need valve repair more often.

Octane ratings also are a concern. While many gasoline-powered engines used on farms were designed to use fuel with octane ratings below those currently produced, oth-

Table 21—U.S. petroleum supply-demand balance, 1982-1983 and projected 1984

Item	1982	1983	Projected 1984
		Million barrels per day	
Demand:			
Gasoline	6.54	6.62	6.70
Diesel fuel	2.67	2.68	2.80
Residual fuel	1.72	1.40	1.51
Other	4.37	4.48	4.69
Total	15.30	15.18	15.70
Supply:			
Production	10.78	10.75	10.80
Net imports (excludes SPR[1])	4.13	4.02	4.97
Net stock withdrawals	0.32	0.26	−0.06
Total primary supply	15.23	15.03	15.71
		Percent	
Change:			
Production		−0.3	0.5
Consumption		−0.8	3.4
Net imports		−2.7	23.6
Net imports share of U.S. supply	27.1	26.7	31.6

[1]SPR = Strategic Petroleum Reserve.

Source: (3).

ers were built to use regular gasoline which has an octane rating of 89. EPA assumes that 89-octane unleaded gasoline will be produced if lead levels are reduced or eliminated, but that prices may be higher than for 87-octane regular unleaded fuel. Costs of producing 89-octane gasoline will increase by about a cent per gallon (5). However, retailers also are likely to increase the markup on this grade and lower the markup on 87-octane gasoline since the lower octane fuel is expected to become the competitive price standard in the future. Thus, farmers may be forced to pay higher prices than they now pay for leaded fuel. If farmers decide to use lower-priced 87-octane unleaded gasoline, some could end up paying for major engine repairs.

EPA also estimates that 2.24 million cars and 1.146 million light-duty trucks manufactured before 1971, and 10.865 million heavy-duty trucks of all ages (including many operated by farmers) run high risks of excessive engine wear without leaded gasoline. EPA suggests, however, that those cars are not likely to have a major problem unless they are operated at speeds above 55 miles per hour for extended periods of time. Trucks, on the other hand, are more vulnerable because they carry heavy loads for long distances. As a result, EPA reports that heavy trucks may be affected significantly if leaded gasoline is not available.

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